

THE LATE-WINTER DIETS OF BARREN-GROUND
CARIBOU IN NORTH-CENTRAL CANADA

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ABSTRACT

Rumen samples from 104 barren-ground caribou (Rangifer tarandus groenlandicus) collected in March 1980 and 1981 at 18 sites on the winter range in south-central Northwest Territories (NWT) and northern Saskatchewan were examined microscopically for relative occurrence of plant fragments. Three hundred point samples of material coarser than 0.85 mm were obtained from each rumen. The composition of plant fragments in the rumens of calves did not differ from that in older caribou. Samples were homogenous within sites and among them. Therefore, we analyzed composite samples for each site and then pooled the data. Terricolous fruticose and foliose lichens averaged $68.6 \pm 1.5\%$ (SE) of tallied fragments at all 18 sites, followed by conifer needles ($11.9 \pm 1.2\%$), green leaves of Vaccinium spp., Ledum spp., and other shrubs and forbs ($5.6 \pm 0.6\%$), twigs and bark ($5.5 \pm 0.4\%$), bryophytes ($4.9 \pm 0.6\%$) and 3.6% unidentified. The lichen component consisted of $8.4 \pm 1.5\%$ Stereocaulon spp., $46.9 \pm 2.6\%$ other fruticose lichens (largely Cladina spp., Cladonia spp., and Cetraria spp.), and $13.2 \pm 1.5\%$ foliose lichens (largely Peltigera spp.).

INTRODUCTION

In 1980, the Canadian Wildlife Service began a study of the winter ecology of barren-ground caribou (Rangifer tarandus groenlandicus). The Beverly Herd was selected as the study herd because hunters and trappers, notably in Fort Smith, NWT, voiced concern over the effects on the herd of the extensive fires that occurred on their winter ranges in the summer of 1979 (Northern Affairs Program 1980).

The first priority was to obtain information on the winter diets of the study herd. The only existing data for caribou herds in north-central Canada were analyses of rumen contents of:

- 1) 302 caribou collected from the adjacent Kaminuriak Herd in November (126), February (14), and April (162) of 1967-1968 (Miller 1976a);
- 2) 28 caribou killed in northern Manitoba and Saskatchewan in February and April of 1972 and 1973 (Miller 1976b);
- and 3) 20 caribou collected from various locations in Manitoba, Saskatchewan, and the NWT (Scotter 1967).

There were no data for March and current data were needed on the apparent diets of caribou from various geographical locations on the winter ranges of the Beverly Herd.

Data on feeding locations and the frequency occurrence of plants in craters dug in the snow by caribou can provide insights into their food habits. Some conclusions about food preferences are possible if such data are combined with information from rumen analyses.

Miller (1976a) provided data on the frequency occurrence of plant genera at feeding sites in northwestern Manitoba and northeastern Saskatchewan in early, mid, and late winter. Miller (1976b) also obtained cover values of species at feeding sites used by caribou in February and April in the same region. The sites were fenced for examination in the summer.

Kelsall (1968) collated data on frequency occurrence of vegetation at several sites cratered by caribou in the NWT and northern Saskatchewan. He also compared data on frequency of occurrence of plants in craters with their frequency in the same general region.

This report gives the results of an analysis of the rumen contents of 104 caribou obtained in March 1980 and 1981 in conjunction with a study of in vitro digestibilities of plants using rumen fluids of caribou (Thomas and Kroeger 1981, Thomas et al. 1984). We also sampled vegetation in caribou craters to investigate the relationship between crater and rumen contents.

METHODS

In March 1980, 50 caribou were obtained from nine locations on the winter range in the NWT. Representative samples of about 500 ml of rumen contents were removed from each caribou within 3 h of death and frozen. Similar-sized samples were chopped from 25 frozen rumens found on four lakes where hunters had killed caribou 1-2 weeks earlier.

The site locations (Fig. 1) were on the following lakes: Bedareh, 22 km south of Bedareh, 10 km southwest of Van Dyke, Van Dyke (two locations), Imogen, Brazen, Huntington, Dardier, Dunvegan, Carleton, and Scott (two sites). The sites were in a 58 x 160 km rectangle between 59° 48' N and 60°20'N and between 106°09'W and 109°38'W.

Several hands-full of vegetation present at the base of 100 craters dug by caribou in late March, 1980, was placed in paper bags, labelled and returned to the laboratory for sorting. Ten bags were obtained at each of seven sites and five bags at each of six sites. Four of the sites were at caribou collection sites and the other nine in the same study region.

In the laboratory, the samples from nine and five caribou obtained at two sites were thawed and 120 ml subsamples were thoroughly washed in a no. 20 sieve (850 μ m) (Bergerud and Russell 1964) to remove particulate matter. A sample of the sieved material was spread in a dish and examined under a stereomicroscope (6X) equipped with a grid ocular. Plant fragments under 50 grid intersections were recorded and the process was repeated on another five sub-samples to yield data for 300 point samples from each rumen subsample.

Species fragments were grouped in the following categories: terrestrial fruticose lichens except Stereocaulon spp., Stereocaulon spp., terrestrial foliose lichens, arboreal lichens, conifer needles, bryophytes, leaves of Ledum groenlandicum, leaves of Vaccinium vitis-idaea var. minus, other evergreen leaves (e.g.

Arctostaphylos spp. and Empetrum nigrum), and twigs and bark and unidentified fragments. Other species groups, including arboreal lichens, graminoids, and forbs were not present or not identified.

First, we tested (t test) for differences in rumen composition between three calves and six older caribou collected at one site. We then tested (ANOVA and Kruskal-Wallis) for homogeneity within nine and five samples from each of the two sites. Rumen samples obtained at a site were then pooled by taking 60 ml from each and mixing them before washing them in the sieve. The results from the 13 sites were then tested for homogeneity by ANOVA and Kurskal-Wallis tests.

In March 1981, 29 rumen samples (four to seven per site) obtained from five sites in the Hurricane and Quinn lakes region of the NWT were analyzed in the same manner. The results were compared to those for 1980 by t test and then combined with them.

The relative abundance of plant species in the bags obtained from the caribou craters were subjectively rated at four levels and given a class symbol: 1=tace amount, 2=scarse, 3=moderately abundant, and 4=abundant. Average abundance values were then calculated for each site by pooling the data. Average relative abundance values were obtained by pooling the data from all 13 sites.

Snow depth was measured adjacent to each caribou crater that was sampled for plant species abundance and at a few additional sites.

RESULTS

1. Dietary Differences in Calves?

The fragment composition in rumens of three calves did not differ ($P < 0.05$) from that of six older caribou. Fragment proportions of Stereocaulon spp., other fruticose lichens and foliose lichens were 7.3 and 9.8%, 61 and 59% and 4.7 and 5.2% in calves and older caribou, respectively.

2. Similarity of Rumen Contents Within Sites

Variations in fragment composition within the two sites examined were not significant. The analyses included the five most abundant plant groups.

3. Similarity of Rumen Contents Among Sites

Variations in rumen composition were not significant among the 13 and 5 sites examined in 1980 and 1981, respectively. Much of the variability in 1980 among sites was caused by the sites at Dunvegan and Carleton lakes where 24% of the fragments were Stereocaulon spp. compared with a high of 14% elsewhere. The proportions of other lichen species at those two sites, located in a region of drumlins (ridges of till), were the lowest of all sites. Proportions of Stereocaulon spp. were low (2-7%) at the seven sites west of 108°W but the total lichen values were similar at all sites, varying from 55-80% of all fragments. Coefficients of variation were lowest for total lichens (CV=10) and highest for evergreen leaves (CV=90).

4. Variation in Rumen Contents Between 1980 and 1981

The results for the five sites obtained in March 1981 were similar ($P < 0.05$ for all classes) to those for 1980. The results for identified plant groups were all within three percentage points of one another except that fruticose lichens varied from 44% in 1980 to 54% in 1981, and Stereocaulon spp. decreased from 13 to 8%.

5. Apparent Diets

Pooled results from March 1980 and 1981 (Table 1) reveal the importance of terricolous lichens to caribou in the study herd.

6. Frequency and Relative Abundance of Plants in Caribou Craters

Lichen genera and species occupied 7 of 10 positions in the list of the most abundant species present in craters dug by caribou in search of forage in March 1980 (Table 2). Cladina mitis was by far the most abundant species in the craters.

7. Relative Availability of forage in March 1980 and 1981

Average snow depths in 1980 at 14 sites varied from 31 to 56 cm and averaged 42 cm. The deepest snow was in the southeast in the Grollier and Robbins lakes region of Saskatchewan and the shallowest in the southwestern limits of the study area.

Snow depths in March 1981 averaged 31 cm (range 27-36 cm) at four sites (Brazen, Abitau, Hurricane and Porter lakes).

DISCUSSION

1. Rumen Composition

Our findings differed little from Miller's (1976a, 1976b) data on the relative dry weights of plants in the rumens of 28 caribou obtained in February and April 1972 and 1973 in northern Manitoba and Saskatchewan.

The major difference was in the grass-like plants (8%) and mushrooms (2-3%) in Miller's (1976a) samples and not detected in ours. The higher composition of lichens in our sample, 68% versus 46-49%, and bryophytes 4-5% versus 2%, is explained by the relatively low specific gravities and high fragmentation of those species (Deardon *et al.* 1975).

Miller's (1976a) data for 302 rumen samples from barren-ground caribou collected on winter ranges in northern Manitoba from 1966 to 1968 are also comparable to ours. Data extracted from his Figure 5 indicate virtually no difference in broad classes of forages consumed by the Kaminuriak Herd between February and April of those years. The approximate average composition by dry weight were lichens 49%, twigs 20%, leaves 21%, grass-like plants 8%, and mushrooms 2% (Miller 1976a).

Scotter (1967) found that lichens accounted for 69% of the dry weight of plants in the rumens of 20 caribou collected in the winter in Saskatchewan, Manitoba, and the NWT. Woody plants (24%), bryophytes and fungi (4%), and grass-like plants (3%) completed the list.

Lichens were also the major component (61%) in the winter diets of barren-ground caribou that wintered on the tundra in southern Keewatin District, NWT, as estimated from relative densities of fragments in fecal samples (Thompson et al. 1978). Mosses, with densities of 23% in southern Keewatin, became dominant at 46 and 51% in northern Keewatin and the Boothia Peninsula, respectively (Fischer et al. 1977). From the boreal forest in the south to the northern arctic islands of Canada, there is in general a progressive decrease in the proportions of lichens and an increase in the proportions of mosses in the diets of R. t. groenlandicus and pearyi, as estimated from rumen and fecal analyses (Fischer and Duncan 1976; Fischer et al. 1977; Parker 1978; Thompson et al. 1978; Thomas and Edmonds 1983).

A comparison of rumen contents (Table 1) with crater contents (Table 2) suggests that Vaccinium vitis idaea is not ingested by caribou in proportion to its occurrence. There appears to be selection for foliose lichens, as Peltigera spp. are the most common foliose lichens in the study area.

Snow depths were about average for late winter in the eastern half of the study area and below average in the west. Therefore, availability of forages under the snow was typical of the winter season from January to March.

The proportionate ingestion of terricolous lichens is undoubtedly higher than is indicated by the above results because of their relatively rapid digestion (Bergerud and Russell 1964, White and Trudell 1980). Furthermore, the relative value of

lichens as an energy source is higher than that of most other forages because lichens are highly digested by caribou (Person et al. 1980b, Thomas and Kroeger 1981, Thomas et al. 1984). Those factors in combination with the data on rumen contents provides overwhelming evidence that terricolous lichens are the most important forage item for barren-ground caribou on winter ranges in north-central Canada.

2. Caribou Craters

Our data on frequency of occurrence of plants in caribou craters differs markedly from Miller's (1976a) data. In general, the occurrences of lichens were much higher in our samples. For example, Cladina mitis occurred in 96% of the craters we examined compared with 56 and 61% for Cladina spp. in his February and April-May samples, respectively. Peltigera spp. occurred in 39% of the craters we sampled compared with 0 and 4% for combined Peltigera spp and Nephroma spp. in his February and April-May sampling periods. Vaccinium vitis idaea occurred in 76% of craters that we examined compared with 13 and 23% occurrence in Miller's (1976a) data for the two periods.

Kelsall's (1968) data on occurrence of plants in 428 feeding craters also varies considerably from ours, with much lower frequencies in most categories, except for Carex spp. We believe that sampling differences account for these differences in crater contents.

3. Rumen Contents vs. Crater Contents

A conclusion derived from examination of the data in Tables 1 and 2 is that caribou ingested less Vaccinium vitis idaea, Ledum spp., and bryophytes that would be expected by their frequency in the craters. For example, Vaccinium vitis idaea occurred in 76% of the craters but its fragments constituted only 2.4% of all fragments tallied in rumen samples.

CONCLUSIONS

1. Rumen contents of barren-ground caribou indicate that lichens that grow on the ground dominate the diets in late winter on forested ranges in north-central Canada.
2. Shrubs and bryophytes were not eaten to the extent that they are available at caribou feeding sites.
3. There was little variation in the diets of barren-ground caribou among years and on different parts of forested winter ranges in north-central Canada.
4. The diets of calves and older caribou were similar.

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TABLE 1. Proportionate occurrence (percent) of plant fragments in composite samples of rumen contents obtained in March 1980 and 1981 from barren-ground caribou at 8 locations on the winter range east of Fort Smith, NWT.

Plant species or groups	Mean	SE	Range
Fruticose lichens	46.9	2.6	25-70
Foliose lichens	13.2	1.5	3-24
Conifer needles	11.9	1.2	3-23
<u>Stereocaulon</u> spp.	8.4	1.5	2-24
Twigs and bark	5.5	0.4	2- 9
Bryophytes	4.9	0.6	0-10
<u>Vaccinium vitis-idaea</u>	2.4	0.3	1- 4
Evergreen leaves ^a	1.4	0.3	0- 4
<u>Ledum</u> spp.	1.8	0.3	0- 4
Unidentified	3.6	0.5	0- 7
Total lichens	68.5	1.5	55-80

^aOther than conifer needles, Vaccinium spp., and Ledum spp.

TABLE 2. Frequency of occurrence and average relative abundance^a of plant genera and species in 100 caribou craters examined in March 1980 at 13 sites on the winter range of the Beverly herd in the southern NWT and northern Saskatchewan.

Plant genus species or group	Occurrence (percent)		Relative abundance ^a	
	Mean	SE	Mean	SE
<u>Cladina mitis</u>	96	14	3.6	0.1
<u>Vaccinium vitis idaea</u>	76	6	1.7	0.2
<u>Cetraria nivalis</u>	69	8	2.0	0.3
<u>Cladonia</u> spp. ^b	69	6	1.1	0.2
<u>Cetraria ericetorum</u>	59	7	1.2	0.1
<u>Stereocaulon</u> spp.	57	8	1.6	0.3
Needles	42	11	1.4	0.2
<u>Cladonia uncialis</u>	40	7	1.1	0.4
<u>Peltigera</u> spp.	39	8	0.9	0.2
<u>Cladonia cornuta</u>	34	5	0.7	0.1
<u>Cladonia amaurocraea</u>	24	6	0.7	0.2
<u>Cladonia rangiferina</u>	24	7	0.7	0.2
<u>Ptilidium ciliare</u>	24	6	0.9	0.2
<u>Ledum</u> spp.	23	8	0.5	0.2
<u>Cladina gracilis</u>	19	4	0.4	0.1
<u>Cladonia coccifera</u>	10	3	0.2	0.1

^a where 1=trace, 2=scarse, 3=moderately abundant, and 4=abundant

^b exclusive of Cladonia amaurocraea, C. cornuta, C. coccifera and C. uncialis, which were treated as individual species.

Figure 1. Locations of sites where caribou rumen samples were obtained in 1980 (dots) and 1981 (crosses).

